Missouri Department of Natural Resources
Water Pollution Control Program

Total Maximum Daily Loads (TMDLs)

for

Saline Creek
Jefferson County, Missouri

Completed December 14, 2000
Approved January 12, 2001

Two Total Maximum Daily Loads (TMDLs)
For Saline Creek
Pollutants: Biochemical Oxygen Demand (BOD) and Ammonia (NH_3N)

Name: Saline Creek

Location: Near Arnold in Jefferson County, Missouri

Hydrologic Unit Code (HUC): 07140102-080004

Water Body Identification (WBID): 2190

Missouri Stream Class: Saline Creek is a Class C stream[1] from the Ron Rog Sewage Treatment Plant (STP) outfall to 0.5 miles below the Highway 141 Sewage Treatment Plant (STP) outfall. The remaining mile of Saline Creek is a Class P stream[2].

Beneficial Uses: Livestock and Wildlife Watering, Protection of Warm Water Aquatic Life and Human Health-Fish Consumption.

Size of Impaired Segment: 2 miles

Location of Impaired Segment: This segment, which starts at the Ron Rog outfall and ends 1.2 miles downstream of the Hwy 141 outfall, is totally contained within Survey 3011, 43N, 5E

Pollutants: BOD and NH_3N

Pollutant Source: Ron Rog STP and Highway 141 STP

Permit Numbers: Ron Rog STP NPDES Permit No. MO-0054151
Highway 141 STP NPDES Permit No. MO-0094552

TMDL Priority Ranking: Medium

1. Background and Water Quality Problems

There are actually two separate portions of Saline Creek that show impairment; one each below the Ron Rog plant and the Hwy 141 plant. These portions are right next to each other and their combined length is two miles. The Ron Rog Sewer Treatment Plant (STP) consists of two contact stabilization plants with a combined design flow of 2.7 cubic feet per second (cfs). This facility discharges wastewater to Saline Creek, which flows easterly through northeastern Jefferson County into the Meramec River eight miles above its mouth. In the upper reaches, Saline Creek is a losing

[1] Class C streams may cease to flow in dry periods but maintain permanent pools which support aquatic life. See 10 CSR 20-7.031(1)(F)

[2] Class P streams maintain flow even during drought conditions. See 10 CSR 20-7.031(1)(F)

stream. Dye studies have shown both Saline and its major tributary, Sugar Creek, send groundwaters to the south that emerge in Romaine Creek. Above the Ron Rog outfall, Saline Creek rarely has surface flow. A few pools are present and can contain minnows, suggesting that there is some subsurface flow in the abundant creek gravels. For the first mile below the Ron Rog outfall about 80-85% of the effluent flow is subsurface, but apparently nearly all of this flow reappears in the creek upstream of the Highway 141 STP. The portion of Saline Creek below the Ron Rog STP is not considered a losing stream and is not listed as such in Missouri's Water Quality Standards (WQS). The Highway 141 STP is smaller than Ron Rog, consisting of two contact stabilization plants with a combined design flow of 1.94 cfs. Below the Hwy 141 outfall, the stream gradient flattens greatly and the stream becomes a series of long pools.

Missouri Department of Natural Resources (MDNR) conducted a water quality study on the receiving stream in August and September 1992 (see Saline Creek Data in Appendix C). It showed low levels of dissolved oxygen below both treatment plants, with the largest sag below the Ron Rog plant. Ammonia levels throughout the study area were as high as 6 milligrams per liter (mg/L). In the September portion of the study, the effluent from both plants was found to be improved, as was instream water quality, but the steam was still considered as not attaining beneficial uses.

The Northeast Public Sewer District (NEPSD) of Jefferson County operates both sewage treatment plants. On April 1, 1996, NESPD agreed to submit a plan within nine months for pretreatment at the Ron Rog facility. A Settlement Agreement was signed between MDNR and NEPSD on June 25, 1997, requiring that NESPD immediately comply with interim limits contained in the permit. This could be accomplished in any way the district chose, including constructing a pipe to the Meramec, which was already included in the district's short-term construction plans. NEPSD also agreed to comply with final effluent limits by Dec. 31, 2000. Due to the absence of an acceptable pretreatment plan and continued effluent violations, NEPSD was issued an Abatement Order, signed by MDNR on Oct. 10, 1999. On April 10, 2000, a pretreatment plan was submitted. On May 17, 2000, the interim effluent limits were achieved.

Due to the long-standing nature of these problems, this TMDL will recommend that NEPSD move the discharge from these two facilities out of the Saline Creek watershed. This should allow Saline Creek to meet water quality standards.

2. Description of the Applicable Water Quality Standards and Endpoint for this TMDL

Designated Uses:
The designated uses of Saline Creek, WBID 2190, are Livestock and Wildlife Watering, and Protection of Warm Water Aquatic Life and Human Health-Fish Consumption. The Class C portion of Saline Creek below Ron Rog STP is an effluent dominated stream and is considered to be a Limited Warm Water Fishery[3]. The Class P portion is under the General Warm Water Fisheries classification. The stream classifications and designated uses may be found at 10 CSR 20-7.031(1)(C) and Table H.

[3] Missouri's Water Quality Standards allow Ozark type Class C streams to be classified as "limited" warm water fisheries in the absence of recreationally important fish species. This two-mile section of Saline Creek is a very small and heavily effluent dominated stream most of the time. It has a very limited fish fauna and does not contain recreationally important species.

Anti-degradation Policy:
Missouri's Water Quality Standards include the EPA "three-tiered" approach to anti-degradation, and may be found at 10 CSR 20-7.031(2).

Tier I defines baseline conditions for all waters -- it requires that existing beneficial uses are protected. TMDLs would normally be based on this tier, assuring that numeric criteria (such as dissolved oxygen, ammonia) are met to protect uses.

Tier II requires no degradation of high-quality waters, unless limited lowering of quality is shown to be necessary for "economic and social development." A clear implementation policy for this tier has not been developed, although if sufficient data on high-quality waters are available, TMDLs could be based on maintaining existing conditions, rather than the minimal Tier I criteria.

Tier III (the most stringent tier) applies to waters designated in the water quality standards as outstanding state and national resource waters; Tier III requires no degradation under any conditions. Management may require no discharge or prohibition of certain polluting activities. TMDLs would need to assure no measurable increase in pollutant loading.

Removal of the discharges from the Saline Creek watershed will result in the protection of existing beneficial uses, which conforms to Missouri's Tier I anti-degradation policy.

Specific Criteria:

Ammonia : The specific criteria, found in Missouri's WQS at 10 CSR 20-7.031(4), apply to all classified waters. The specific criteria for the ammonia TMDL are found in 10CSR20-7.031 Table B. These limits are pH and water temperature dependent. Seasonal ammonia limits at the typical seasonal pH and water temperature values are given in Tables 1 and 2. These tables have divided the stream into the Class C and P portions.

Biochemical Oxygen Demand (BOD): Dissolved oxygen (DO) is the water quality standard that is exceeded in Saline Creek. DO is critical for the health of aquatic life and is not a pollutant. It also cannot be allocated in a TMDL. BOD is generally the pollutant used to determine the impact that sewer treatment plant (STP) discharges will have on DO levels in a receiving stream. There is no numeric criterion in the WQS for BOD. Since DO cannot be allocated, oxygen levels must be linked to BOD when the source of the problem is a sewage treatment plant. State WQS for all Missouri streams except cold water fisheries call for maintenance of 5 mg/L dissolved oxygen[4] or the normal background level of dissolved oxygen, whichever is lower.[5] Since the normal background level for dissolved oxygen cannot be calculated due to insufficient data, 5.0 mg/L DO has been chosen.

For Saline Creek to meet WQS, the BOD load coming from the STPs must be addressed. This normally would be achieved by determining the load capacity for BOD in the receiving stream. Due to natural conditions existing on Saline Creek, little or no upstream dilution and no mixing zone allowances, it would be technologically difficult for the STPs to meet the loading needed to resolve the impairment of Saline Creek. As plans were already being developed to move the

[4] 10 CSR 20-7.031(4)(J)
[5] 10 CSR 20-7.031(4)(A)(3)

discharge out the watershed, it seemed most appropriate that this TMDL help expedite the existing plan.

Mixing zone: Since there will be no discharge from Ron Rog and Hwy 141 STPs, there is no mixing zone.

Summary of Numeric Instream Criteria: Tables 1and 2 summarize the instream numeric criteria from the Missouri Water Quality Standards.

Table 1: Instream Criteria for Ron Rog and Hwy 141 STP (C portion)

Diss. Oxygen (mg/l) May-Oct. *Diss. Oxygen(mg/l) Nov.-April*	*5.0* *5.0*
Ammonia (mg/l), May-Oct. *(pH 7.8, Temperature 26° C)*	*2.0*
Ammonia (mg/l), Nov.-April *(pH 7.8, Temperature 6° C)*	*3.3*

Table 2: Instream Criteria for Hwy 141 STP (P portion)

Diss. Oxygen (mg/L) May-Oct. *Diss. Oxygen (mg/L) Nov.-April*	*5.0* *5.0*
Ammonia (mg/L), May-Oct. *(pH 7.8, Temperature 26° C)*	*1.2*
Ammonia (mg/L), Nov.-April *(pH 7.8, Temperature 6° C)*	*2.1*

Endpoint for this TMDL:
For several years DNR has urged NEPSD to come into compliance with water quality standards. The method for attaining compliance was their choice. Now, DNR will require all effluent from Ron Rog and Hwy 141 STPs being discharged into Saline Creek to be removed from the watershed. This can be accomplished by constructing a pipe to the Meramec River or farther, or by connecting to regional sewers.

3. Calculation of Load Capacity

Since the discharges from these two STPs are to be removed from the Saline Creek watershed, there is no Load Capacity at the critical low flow 7Q10 flow of zero. If this TMDL needs to be reopened after evaluation of future monitoring results, load capacity would be recalculated at that time.

4. Load Allocation (Nonpoint Source Load)

There is no upstream flow in Saline Creek at the 7Q10[6] low flow, and only very rarely at other times due to the losing nature of upper Saline and its tributaries. Therefore, no nonpoint source (NPS) impacts from upstream are believed to exist during low flow conditions. About half the floodplain of the Saline Creek study area is in row crops and there is no agriculture outside the floodplain. There is little or no livestock production in the basin. Agriculture is not believed to have an NPS impact during low flow conditions. Throughout the study reach the stream parallels Highway 141, a major four-lane divided highway with considerable adjoining residential and commercial development. These nonpoint sources are not likely to contribute to the impairments of BOD and ammonia. Post implementation monitoring will assess whether there are any unidentified NPS contributions. If there are, MDNR will reopen this TMDL and revise it appropriately in response to the new data. Nothing is being allocated for NPS at this time.

5. Waste Load Allocation (Point Source Loads)

There are six small permitted wastewater discharges from extended aeration plants in the upper parts of the Saline or Sugar Creek watershed. Because of the "losing nature" of the upper Saline, none of the flows from these plants is believed to reach the study area except during exceptionally heavy rains. Sugar Creek joins Saline below Hwy 141 and the data shows no increased contamination from this tributary. The impaired segment's upstream end begins at the Ron Rog STP and ends below Highway 141 STP before Saline Creek joins the Meramec River. The Ron Rog and Highway 141 STPs are the only point source loads discharging to the impaired segment of Saline Creek. Since this discharge is being removed from the watershed, the Wasteload Allocation will be zero pounds per day.

6. Margin of Safety

The margin of safety for this TMDL is implicit in the decision to remove the discharge from the Saline Creek watershed.

7. Seasonal Variation

Seasonal variation for ammonia is addressed in the standards. Maintenance of 5 mg/L dissolved oxygen applies to all seasons, including critical low flow conditions.

8. Monitoring Plans

The Missouri Department of Natural Resources' (MDNR) St. Louis Regional Office will check the plant sites at six-month intervals to determine when NEPSD completes redirecting discharge from Ron Rog and Hwy 141 STPs out of the Saline Creek watershed. MDNR's Water Pollution Control Program will do a stream survey of Saline Creek in the vicinity of these two STPs within two years of removing the discharge, and will determine at that time whether applicable water quality standards are met, or if nonpoint sources are having an impact.

[6] The 7-day average minimum flow with a recurrence interval of 10 years. Indicates drought conditions.

9. Implementation Plans

For several years MDNR has urged the NEPSD to come into compliance with Missouri's water quality standards (WQS). The method for attaining compliance was their choice. Now, MDNR will require all effluent from Ron Rog and Hwy 141 STPs being discharged into Saline Creek to be removed from the watershed. This will be written into the permits for the two STPs and can be accomplished by constructing a pipe to the Meramec River or farther, or by connecting to regional sewers. Once completed, this requirement should assure that WQS will be met in Saline Creek. After the stream survey conducted by MDNR (mentioned under the Monitoring Plans section above) is completed, MDNR will assess whether applicable water quality standards are met. If standards are met, then MDNR will delist Saline Creek for dissolved oxygen and ammonia. If standards are not met, MDNR will reopen this TMDL and revise it appropriately to meet all applicable statutes and regulations. This TMDL will be incorporated into Missouri's Water Quality Management Plan.

10. Reasonable Assurances

The MDNR has the authority to write and enforce NPDES permits. Inclusion of the requirement to remove all discharge from Ron Rog and Hwy 141 STPs from the Saline Creek watershed, established in this TMDL, into a state NPDES permit should provide reasonable assurance that instream water quality standards will be met.

11. Public Participation

This water quality limited segment is included on the approved 1998 303(d) list for Missouri. The Missouri Department of Natural Resources developed this TMDL. A public notice period was held from Oct. 27 to Nov. 26, 2000. Groups receiving the public notice announcement included the Missouri Clean Water Commission, the affected facility, the Water Quality Coordinating Committee, the TMDL Advisory Committee, Stream Team volunteers in the watershed, and others that routinely receive the public notice of NPDES permits. Comments were received from Northeast Public Sewer District, the Meramec River Recreation Association, Sierra Club and the Missouri Chapter of American Fisheries Society. Some adjustments were made to the TMDL document in response to comments received, but the overall approach and the numeric targets remain unchanged. Copies of the notice, the comments and MDNR's response to the comments are on file with MDNR.

12. Appendices and documents on file with MDNR

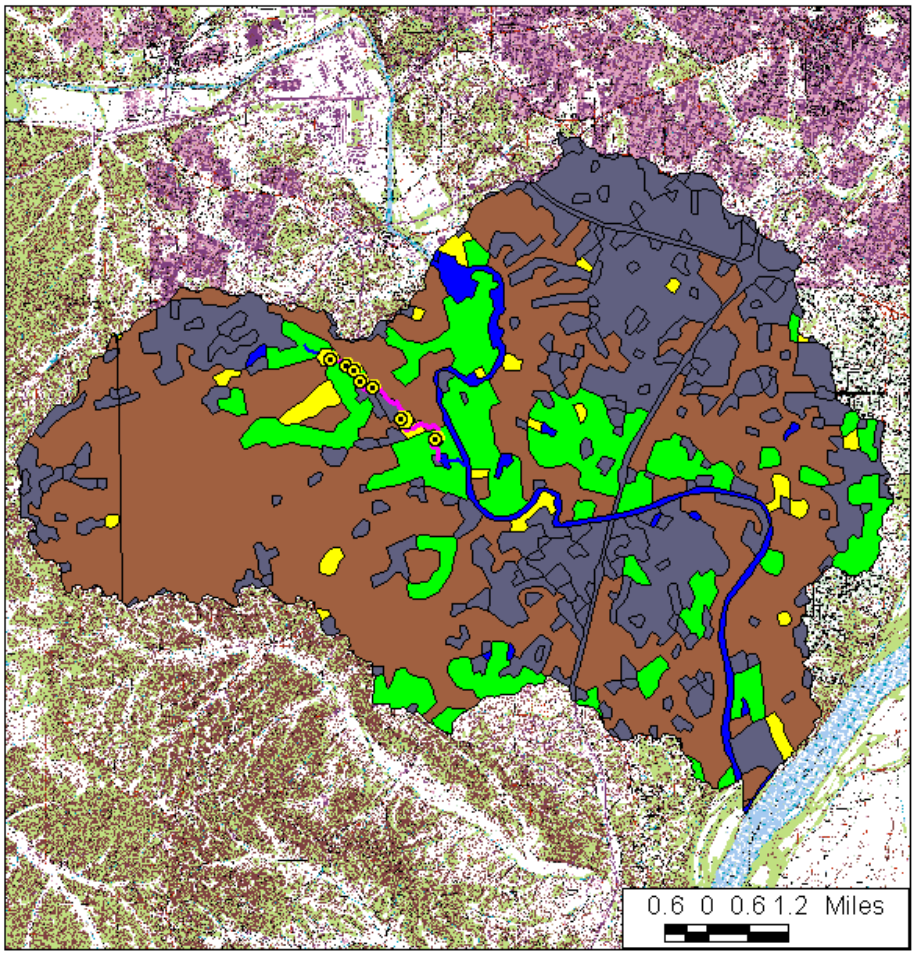
Appendix A – Land Use Types for Saline Creek Watershed
Appendix B – Map of Sample Locations and Impaired Stream Segment
Appendix C – Saline Creek Data

Documents on file with MDNR:

Ron Rog STP - NPDES Permit No. MO-0054151
Highway 141 STP - NPDES Permit No. MO-0094552

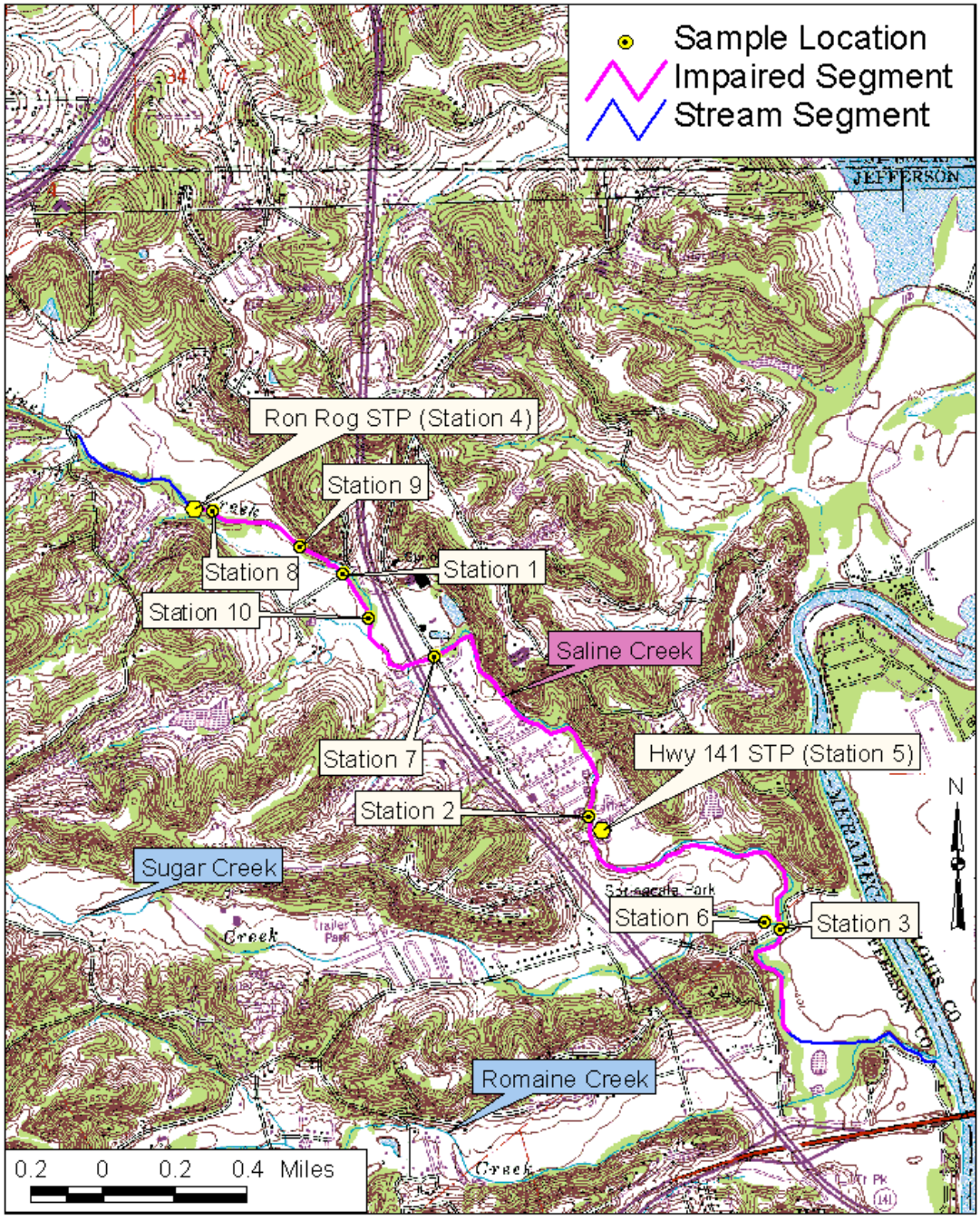
Analysis of Treatment Requirements for Northeast Sewer District Ron Rog and Highway 141 Sewer Treatment Plants (August and September, 1992)
Addendum to Saline Creek Water Quality Model, August 18, 1995
1997 Settlement Agreement and cover letter
1999 Abatement Order
Public Notice announcement
Public comments
MDNR's response to public comments

Appendix A. Land Use Types for Saline Creek Watershed (07140102-080004)



Land Use Type		Area (acres)
Urban or Built-up Land		14352
Residential	9854	
Commercial and Services	1433	
Industrial	428	
Trans, Comm, Util	599	
Mixed Urban or Built-up	1120	
Other Urban or Built-up	918	
Agricultural Land		6439
Cropland and Pasture	6439	
Forest Land		22154
Deciduous Forest Land	22154	
Water		1139
Streams and Canals	966	
Reservoirs	173	
Barren Land		920
Strip Mines	473	
Transitional Areas	447	
Unclassified		1

Appendix B. Map of Sample Locations and Impaired Stream Segment
Saline Creek, Jefferson County, Missouri



APPENDIX C

SALINE CREEK DATA

SITE	*SITE DESCRIPTION*	*DATE*	*TIME*	*FLOW CFS*	*TEMP 0C*	*DO mg/L*	*CONDUCT uS*	*pH*	*NH4 mg/L*	*NO3 mg/L*	*CBOD mg/L*
1	SALINE CREEK 0.6 MILE BELOW RON ROG TREATMENT PLANT	8/18/1992	1308	1.50	23	3.2	765	7.50	4.0	3.0	<4
1	SALINE CREEK 0.6 MILE BELOW RON ROG TREATMENT PLANT	8/19/1992	0649		22	2.1	900	7.10	3.0	5.0	<4
1	SALINE CREEK 0.6 MILE BELOW RON ROG TREATMENT PLANT	8/19/1992	1255		24	2.9	800	7.45	6.4	6.9	<4
1	SALINE CREEK 0.6 MILE BELOW RON ROG TREATMENT PLANT	8/20/1992	0647		20	2.5	885	7.30	6.5	8.7	<4
1	SALINE CREEK 0.6 MILE BELOW RON ROG TREATMENT PLANT	9/15/1992	1244	0.30	25	5.7	780	7.60	0.13	8.0	<4
1	SALINE CREEK 0.6 MILE BELOW RON ROG TREATMENT PLANT	9/16/1992	0735		22	4.8	920	7.40	0.06	9.0	<4
1	SALINE CREEK 0.6 MILE BELOW RON ROG TREATMENT PLANT	9/16/1992	1253		25	6.6	860	7.60	0.05	10.0	<4
1	SALINE CREEK 0.6 MILE BELOW RON ROG TREATMENT PLANT	9/17/1992	0715		21	4.7	940	7.30			
2	SALINE CREEK 1.6 MILE BELOW RON ROG TREATMENT PLANT	8/18/1992	1255		22	13.5	640	7.80	<.05	2.0	5
2	SALINE CREEK 1.6 MILE BELOW RON ROG TREATMENT PLANT	8/19/1992	0640		21	4.5	780	7.00	<.05	2.0	<4
2	SALINE CREEK 1.6 MILE BELOW RON ROG TREATMENT PLANT	8/19/1992	1247		23	11.2	700	7.50	5.8	2.9	
2	SALINE CREEK 1.6 MILE BELOW RON ROG TREATMENT PLANT	8/20/1992	0639		19	5.9	800	7.10	6.0	4.6	<4
2	SALINE CREEK 1.6 MILE BELOW RON ROG TREATMENT PLANT	9/15/1992	1228	1.80	23	9.8	620	7.70	<.05	4.0	<4
2	SALINE CREEK 1.6 MILE BELOW RON ROG TREATMENT PLANT	9/16/1992	0745		21	6.3	830	7.20	<.05	4.0	<4
2	SALINE CREEK 1.6 MILE BELOW RON ROG TREATMENT PLANT	9/16/1992	1236		23	10.3	700	7.50	<.05	5.0	<4
2	SALINE CREEK 1.6 MILE BELOW RON ROG TREATMENT PLANT	9/17/1992	0657		20	6.0	790	7.20	<.05	4.0	<4
2	SALINE CREEK 1.6 MILE BELOW RON ROG TREATMENT PLANT	7/19/1995	0530	2.70	24	4.4	727		0.07	6.0	<1
2	SALINE CREEK 1.6 MILE BELOW RON ROG TREATMENT PLANT	7/20/1995	0530		24	3.6	747		0.08	6.4	<1
3	SALINE CREEK 0.6 MILE BELOW HIGHWAY 141 TREATMENT	8/18/1992	1240	2.00	20	5.3	660	7.40	1.0	3.0	<4
3	SALINE CREEK 0.6 MILE BELOW HIGHWAY 141 TREATMENT	8/19/1992	0627		22	3.5	760	6.80	1.0	3.0	<4
3	SALINE CREEK 0.6 MILE BELOW HIGHWAY 141 TREATMENT	8/19/1992	1234		22	5.0	720	7.15	6.4	3.1	<4

SITE	SITE DESCRIPTION	DATE	TIME	FLOW CFS	TEMP 0C	DO mg/L	CONDUCT uS	pH	NH4 mg/L	NO3 mg/L	CBOD mg/L
3	SALINE CREEK 0.6 MILE BELOW HIGHWAY 141 TREATMENT	8/20/1992	0624		20	4.3	780	7.00	6.4	3.7	<4
3	SALINE CREEK 0.6 MILE BELOW HIGHWAY 141 TREATMENT	9/15/1992	1216		22	5.6	600	7.40	0.13	4.0	<2
3	SALINE CREEK 0.6 MILE BELOW HIGHWAY 141 TREATMENT	9/16/1992	0652		21	4.8	820	7.40	0.16	4.0	<4
3	SALINE CREEK 0.6 MILE BELOW HIGHWAY 141 TREATMENT	9/16/1992	1225		22	5.5	700	7.20	0.16	4.0	<4
3	SALINE CREEK 0.6 MILE BELOW HIGHWAY 141 TREATMENT	9/17/1992	0639		21	4.6	770	7.10			
4	RON ROG TREATMENT PLANT EFFLUENT	8/18/1992	1340	1.50	24	7.3	780		4.0	4.0	<4
4	RON ROG TREATMENT PLANT EFFLUENT	8/19/1992	0707		22	5.2	940	7.30	7.7	8.5	<4
4	RON ROG TREATMENT PLANT EFFLUENT	8/19/1992	0710		24	6.6	940	7.00	4.0	6.0	<4
4	RON ROG TREATMENT PLANT EFFLUENT	8/19/1992	1320		25	7.3	820	7.05	6.4	7.6	<4
4	RON ROG TREATMENT PLANT EFFLUENT	9/15/1992	1307	0.30	25	7.0	780	7.60	0.40	8.0	<4
4	RON ROG TREATMENT PLANT EFFLUENT	9/16/1992	0758			6.4	930	7.30	0.19	8.0	<4
4	RON ROG TREATMENT PLANT EFFLUENT	9/16/1992	1313		25	7.4	820	7.60	0.17	11.0	<4
4	RON ROG TREATMENT PLANT EFFLUENT	9/17/1992	0738		24	7.0	920	7.40	0.32	8.0	<4
5	HIGHWAY 141 TREATMENT PLANT EFFLUENT	8/18/1992							10.0	1.0	5
5	HIGHWAY 141 TREATMENT PLANT EFFLUENT	8/19/1992							25.0	2.8	5
5	HIGHWAY 141 TREATMENT PLANT EFFLUENT	8/19/1992	0739	0.50	24	7.5	600	6.90	2.0	5.0	9
5	HIGHWAY 141 TREATMENT PLANT EFFLUENT	8/20/1992	0732		24		680	7.30	6.2	9.4	9
5	HIGHWAY 141 TREATMENT PLANT EFFLUENT	9/15/1992							4.0	2.0	4
5	HIGHWAY 141 TREATMENT PLANT EFFLUENT	9/16/1992	0712	0.37	24	7.4	620	7.30	0.25	4.0	5
5	HIGHWAY 141 TREATMENT PLANT EFFLUENT	9/16/1992	1400						0.49	11.0	<4
5	HIGHWAY 141 TREATMENT PLANT EFFLUENT	9/17/1992	0653		24	7.2	660	7.20	0.15	7.0	<4
6	SUGAR CREEK AT MOUTH	9/16/1992	0700	0.10		4.8	620	7.40	0.05	1.0	<2
7	BRIDGE AT NURSEY	9/15/1992	1237	0.35	24	9.0	740	7.80			
7	BRIDGE AT NURSEY	9/16/1992	0726		20	6.1	860	7.40			

SITE	SITE DESCRIPTION	DATE	TIME	FLOW CFS	TEMP 0C	DO mg/L	CONDUCT uS	pH	NH4 mg/L	NO3 mg/L	CBOD mg/L
7	BRIDGE AT NURSEY	9/16/1992	1244		23	9.6	800	7.70			
7	BRIDGE AT NURSEY	9/17/1992	0707		19	6.2	870	7.30			
8	SALINE CREEK 20 YARDS BELOW RON ROG TREATMENT PLANT	7/18/1995	1715						0.70	17.7	7
8	SALINE CREEK 20 YARDS BELOW RON ROG TREATMENT PLANT	7/19/1995	0800						2.04	13.6	34
8	SALINE CREEK 20 YARDS BELOW RON ROG TREATMENT PLANT	7/19/1995	1710						1.7	15.2	9
9	SALINE CREEK 0.4 MILE BELOW RON ROG TREATMENT PLANT	7/19/1995	1030	2.60					0.13	16.8	<1
10	SALINE CREEK 0.8 MILE BELOW RON ROG TREATMENT PLANT	7/19/1995	0540	1.80	22	3.6	769				
10	SALINE CREEK 0.8 MILE BELOW RON ROG TREATMENT PLANT	7/20/1995	0545		23	2.9	810				